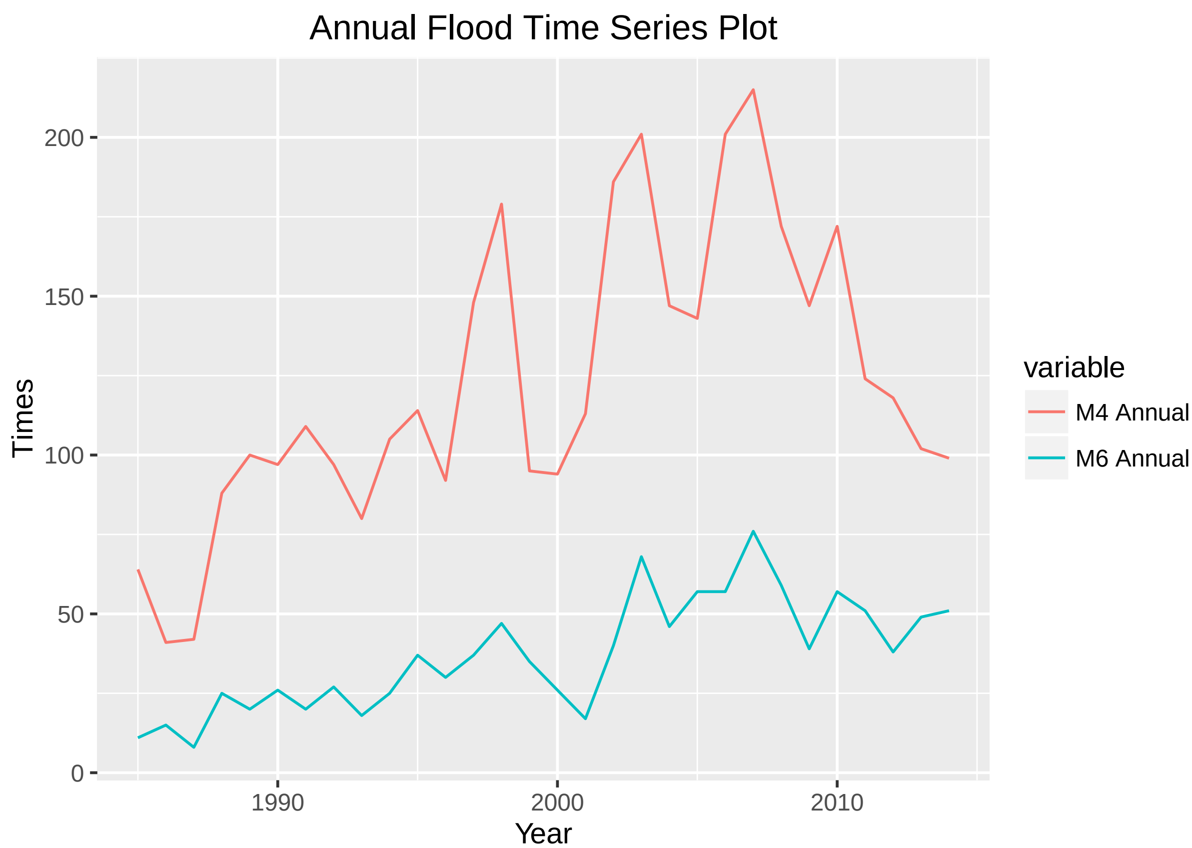
report2_final

ggMonet

March 8, 2016

Time Series Plot of Floods

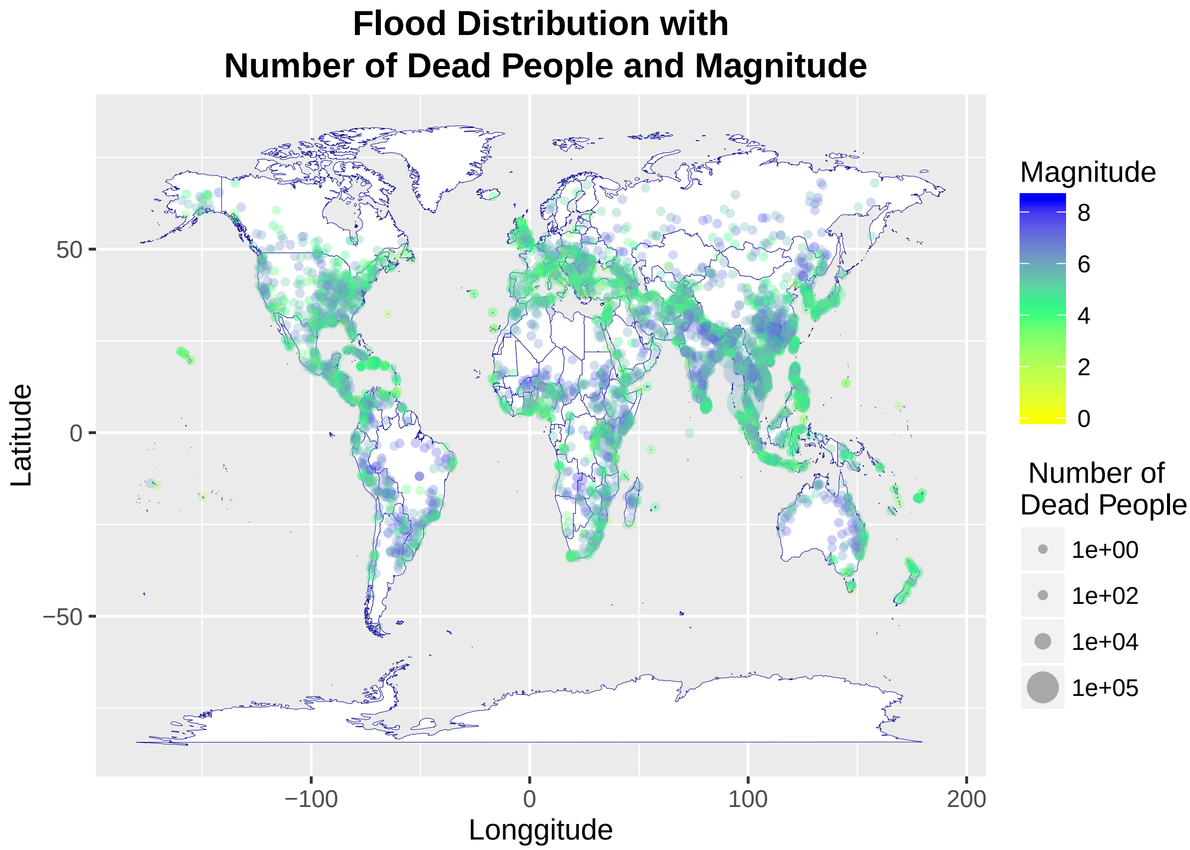


We can see a greater flucuation in the number of M4 floods than M6 floods, and the occurrences of floods of both degrees are highly correlated. After a view of the distribution of floods in time, we will present the spatial distribution.

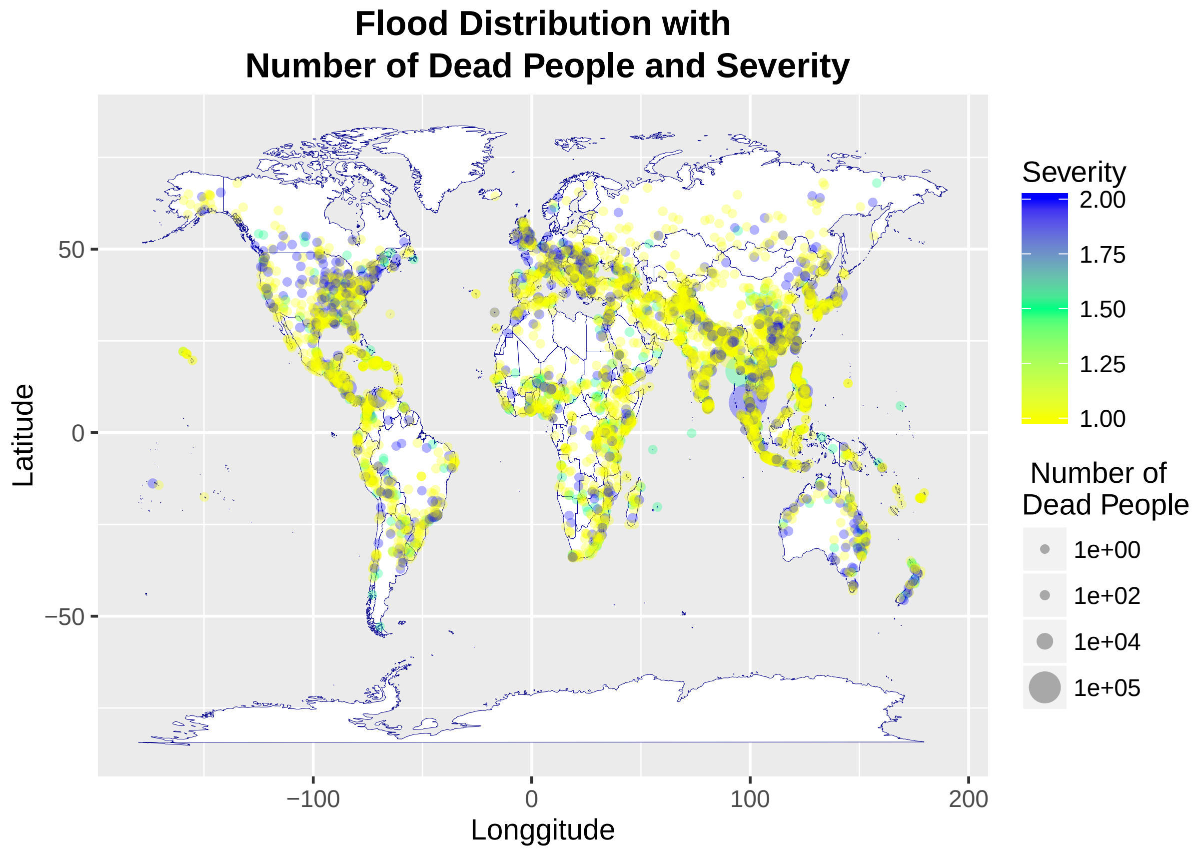
Spatial Distribution of Floods

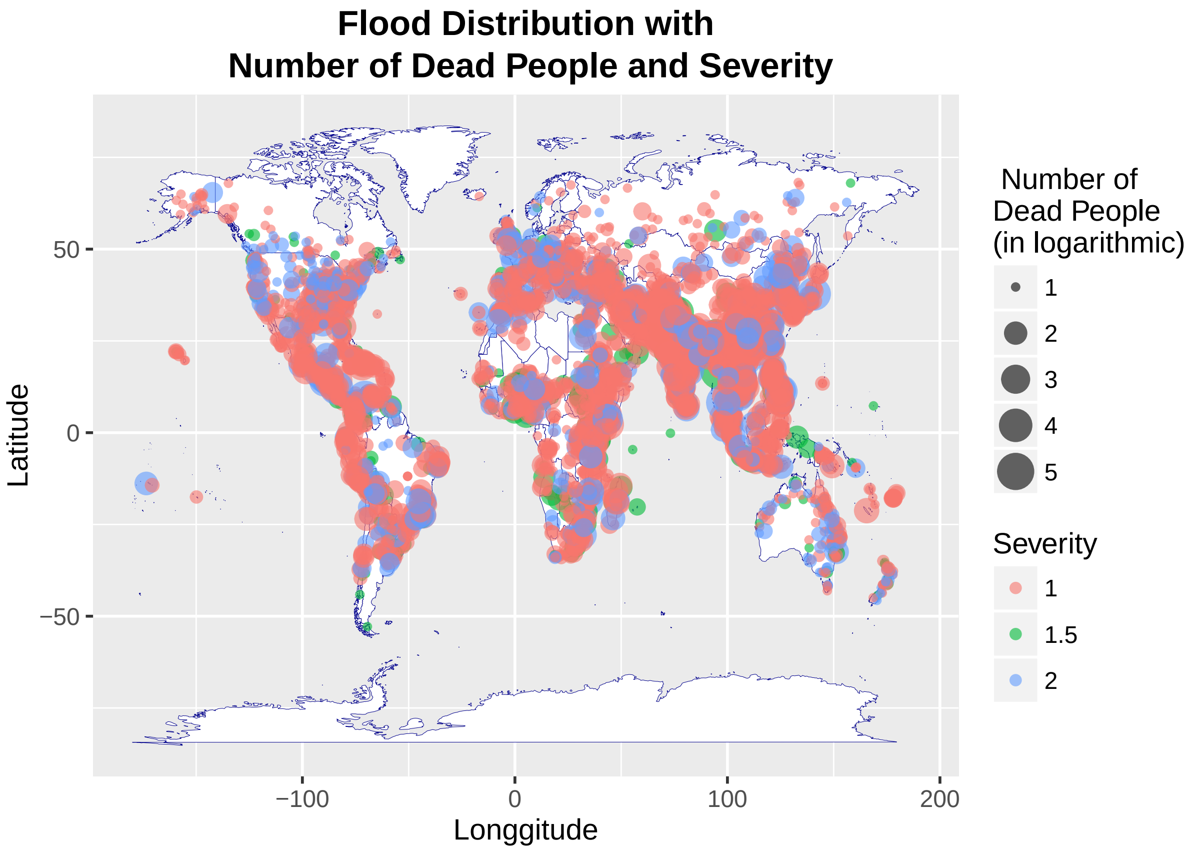
```
## [1] "numeric"
```

We preprocessed data by identifying the top 4 main reasons among these 10 causes based on some key words.

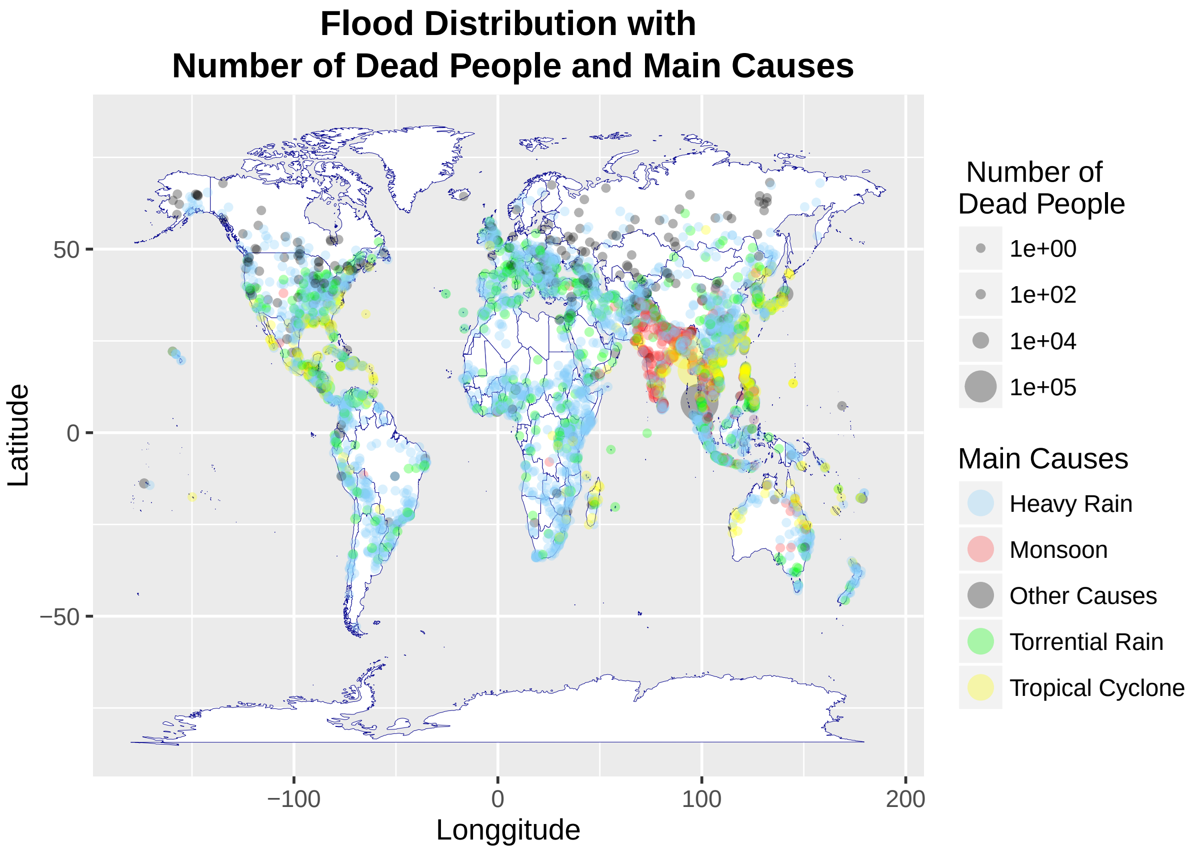


From this distribution plot, combining the magnitude and the number of deaths, we can learn that the floods in East Asia and South Asia had both higher magnitude and larger number of deaths. Specifically, in Malaysia and Thailand, there were several highly serious floods, which resulted in over one hundred thousand people losing their lives. Besides, the East US and Europe also had comparatively more floods with lower magnitude. However, in the southeast coast of South America, the floods suffered from higher magnitudes on average.

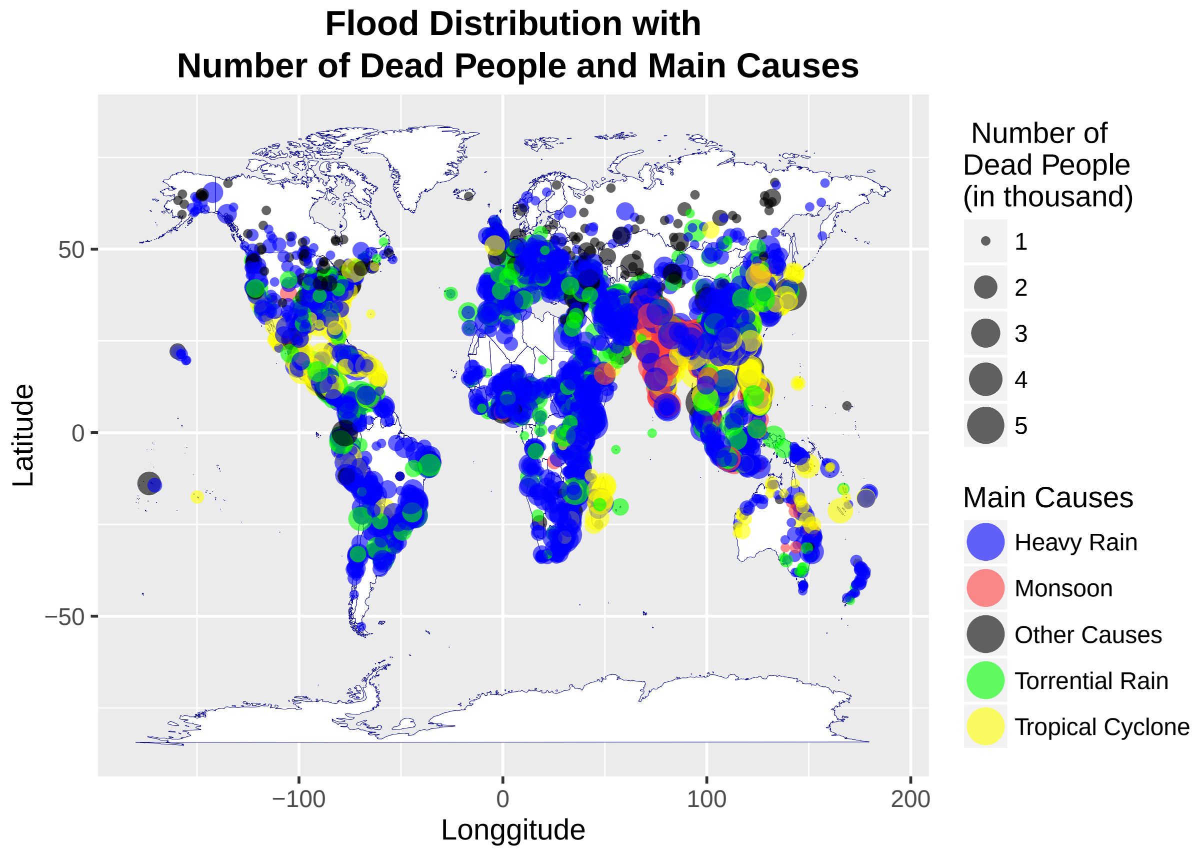

Flood Distribution with
Number of Dead People and Severity
Latitude
50
0
−50
−100
0
100
200
Longgitude
Severity
2.00
1.75
1.50
1.25
1.00
Number of
Dead People
1e+00
1e+02
1e+04
1e+05



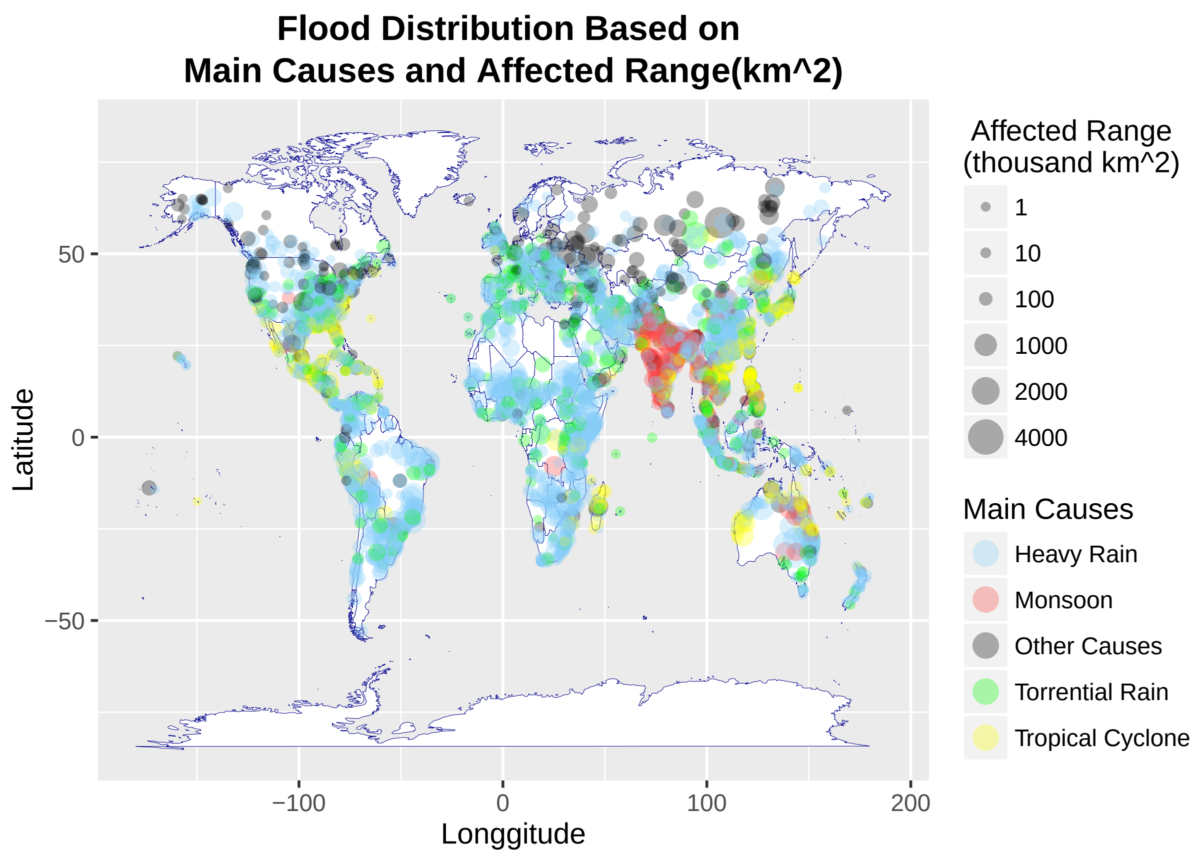
From this distribution plot, combining the severity and the number of deaths, we can see that Europe had the densest floods with high severity. Compared to these, the floods in Asia had higher densities but lower severity. But still, the most serious flood around Malaysia had the most severity and the largest number of deaths at the same time. We also notice that in other places like Russia and Africa, the floods had the lowest severities.



Flood Distribution with
Number of Dead People and Main Causes
Latitude
50
0
−50
−100
0
100
200
Longgitude
Number of
Dead People
1e+00
1e+02
1e+04
1e+05
Main Causes
Heavy Rain
Monsoon
Other Causes
Torrential Rain
Tropical Cyclone

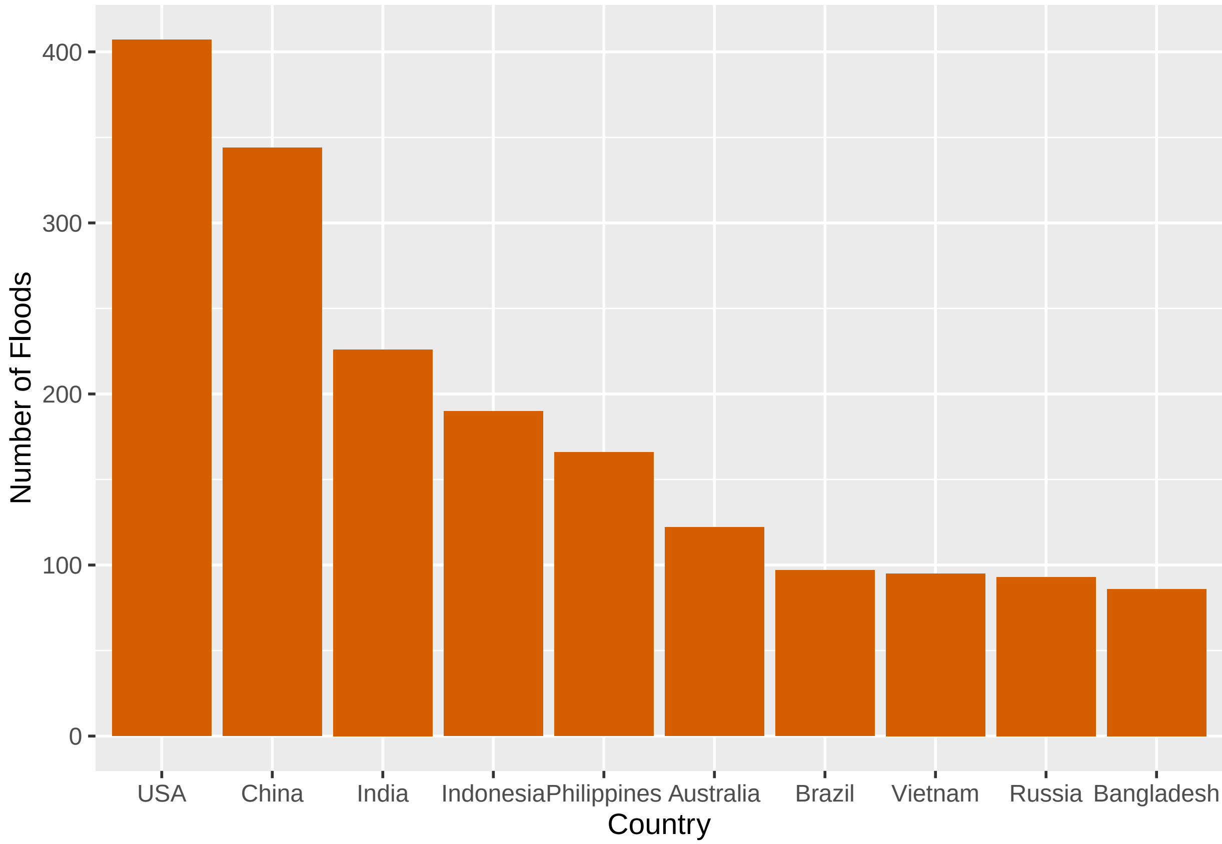


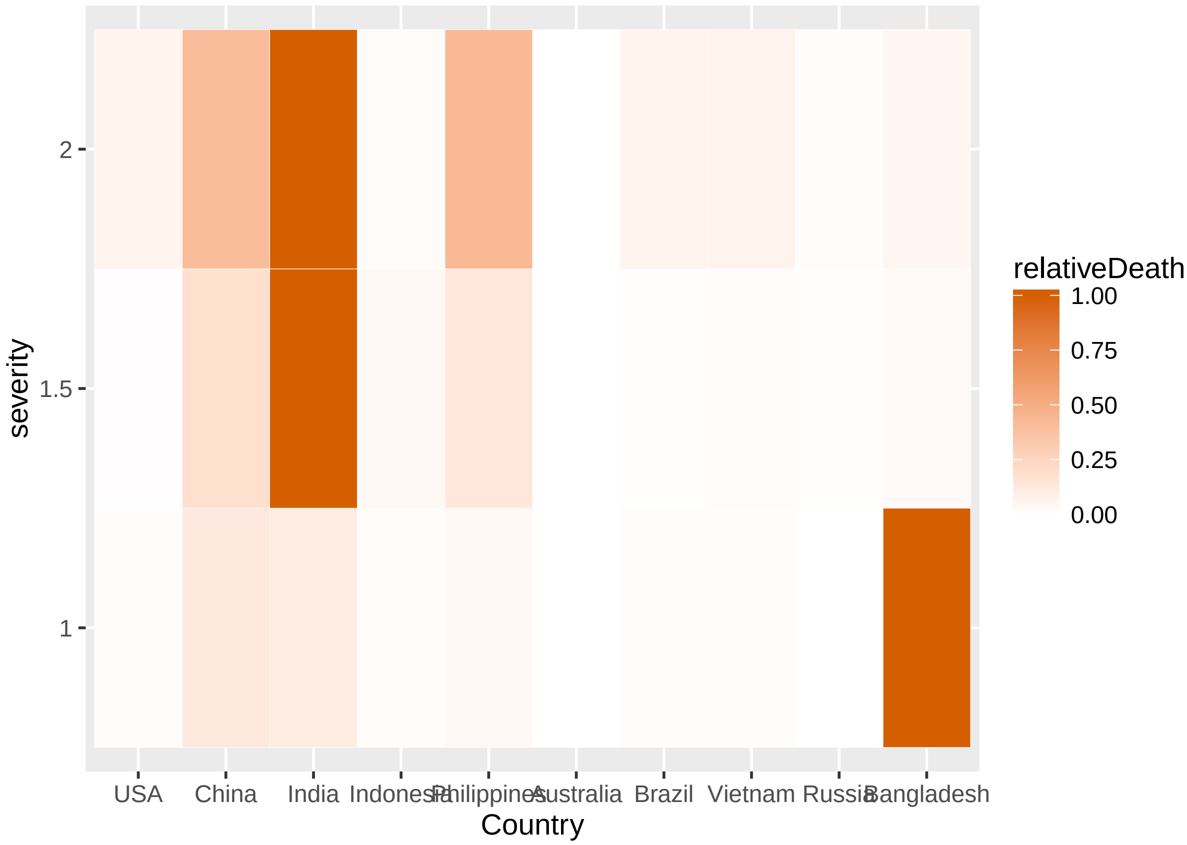
This time, we analyze the relationship between the main reasons behind these floods and the number of deaths. From the corresponding distribution plot, the following conclusions can be drawn. Firstly, the most common reason in the whole wide world is Heavy Rain, especially in Africa. Then, we find the floods in India mostly resulted from Monsoon, which seems to be the exclusive reason. Besides, the floods cased by tropical Cyclone were concentrated on the South Asia and South US. The dense floods in Europe were caused by a combination of Heavy Rain, Torrential Rain and other reasons. As for the floods in Russia, the reasons behind them seems to be uncommon, at least compared to other places.



In the end, we compare the distributions between the main causes and the affected range (square kilometer). From the picture, we can see that the floods in India caused by Monsoon seem to have the one of largest affected scopes. Besides, the causes behinds the intensive floods in South Asia were highly complicated, leading to comparatively small affected ranges with surprise. For example, the most terrible flood in Malaysia that we've discussed seems to have an unexpected small range. The situations of East China and East US seem to be similar: large affected ranges and various reasons behind these dense floods. On the top of these coast areas, the floods in Russia mainland also had large affected ranges.

Floods in Several Countries

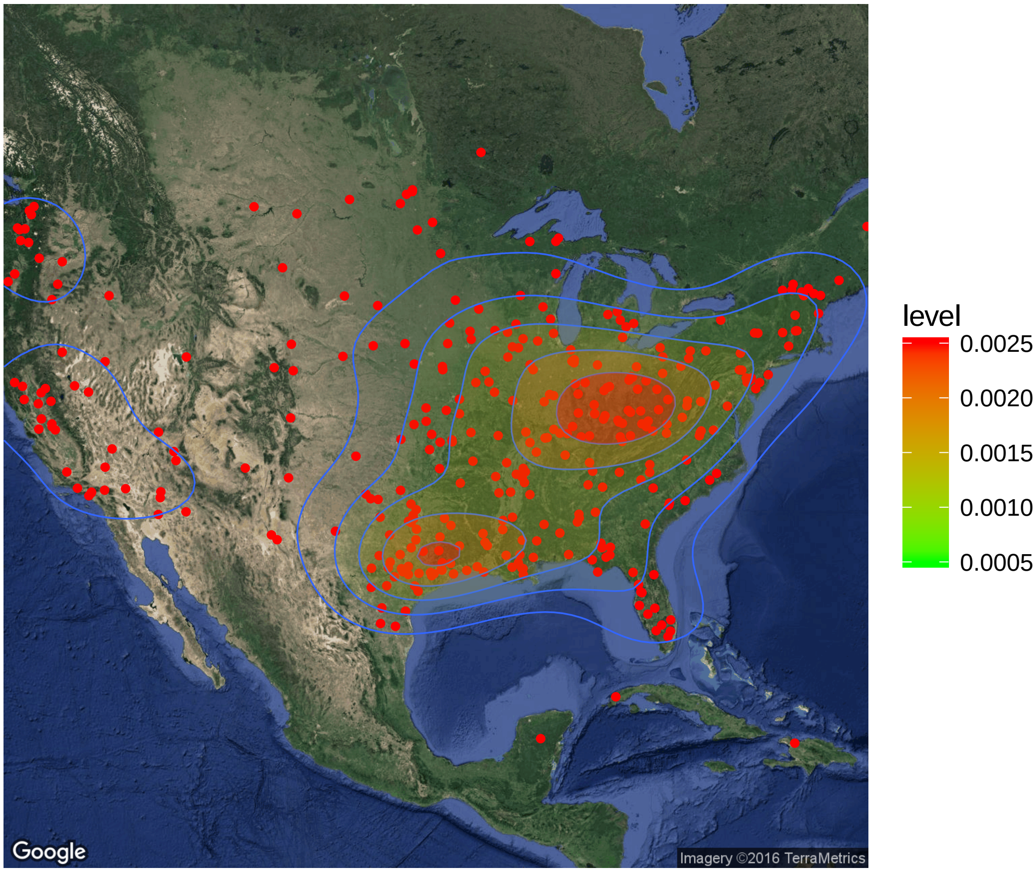




As we can see, USA, China and India are the top three frequently impacted countries. In the next part, we will have a more detailed look into the distributions of floods happened in the three countries. And from the heatmap of the relative death (rescaled by the most death occurred in a certain severity), we can see that USA did a great job in preventing death in floods while India and Bangladesh did not.

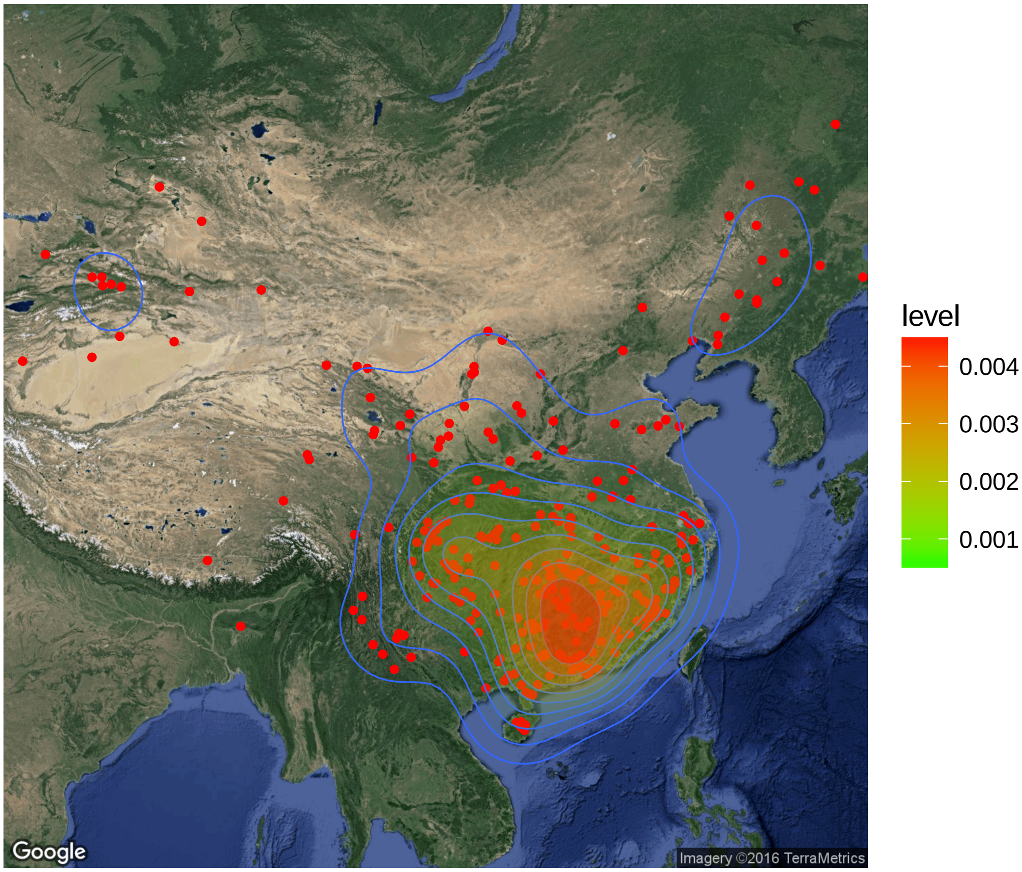
Here, we will describe distribution of floods in USA, China and India.

Firstly, we will draw a case of USA.



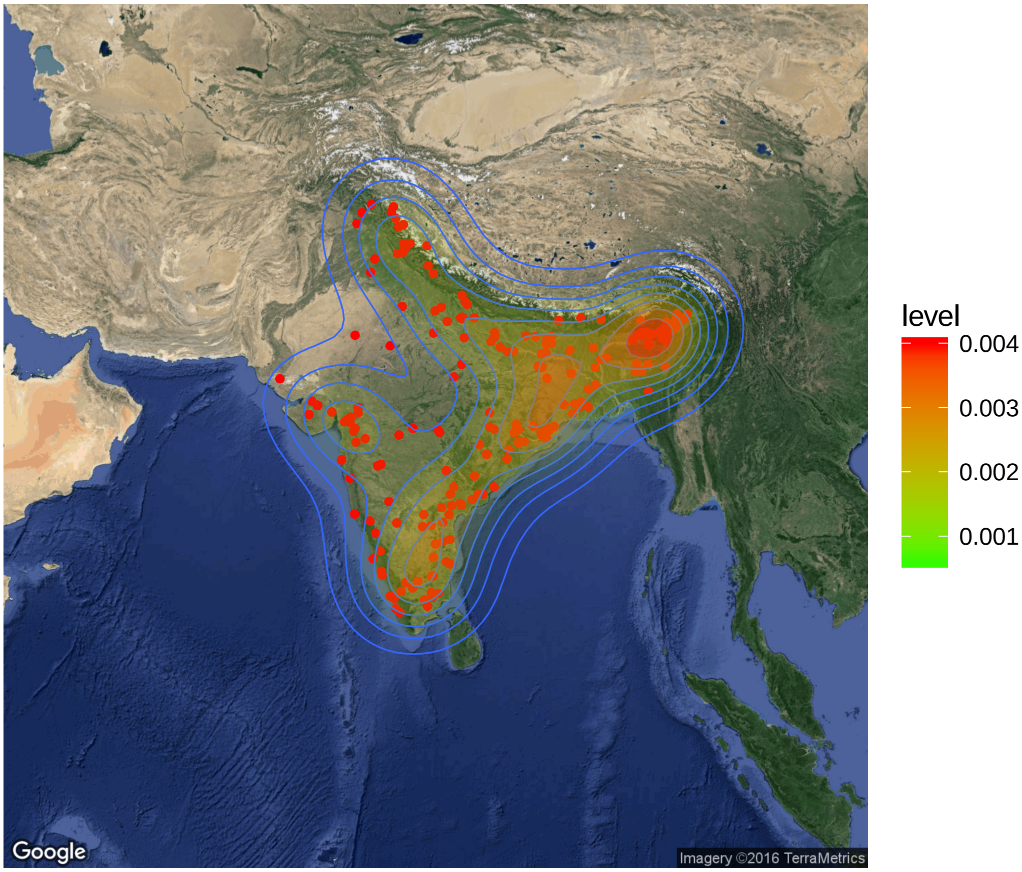
We draw contours based on where floods happened in the past. At the areas which have red color, they had floods many times. As the color turns green, the numbers of floods occurrence decrease. In the case of USA, floods often happened at coastlands. Also, we can see that floods often happened at the middle east area.

Secondly, we will draw a case of China.



In the same way as USA, floods often happened at coastlands in China. We can see that at the area of south east, floods frequently happened.

Thirdly, we will draw a case of India.

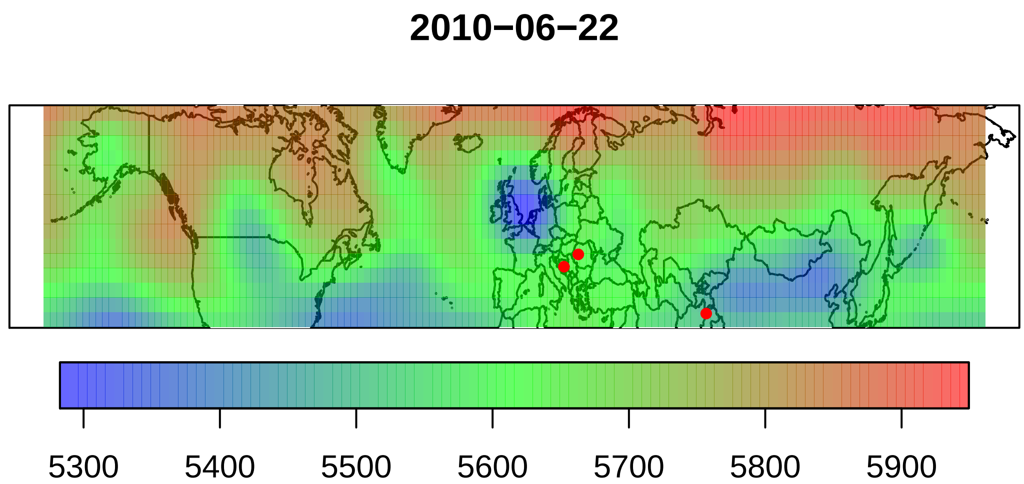


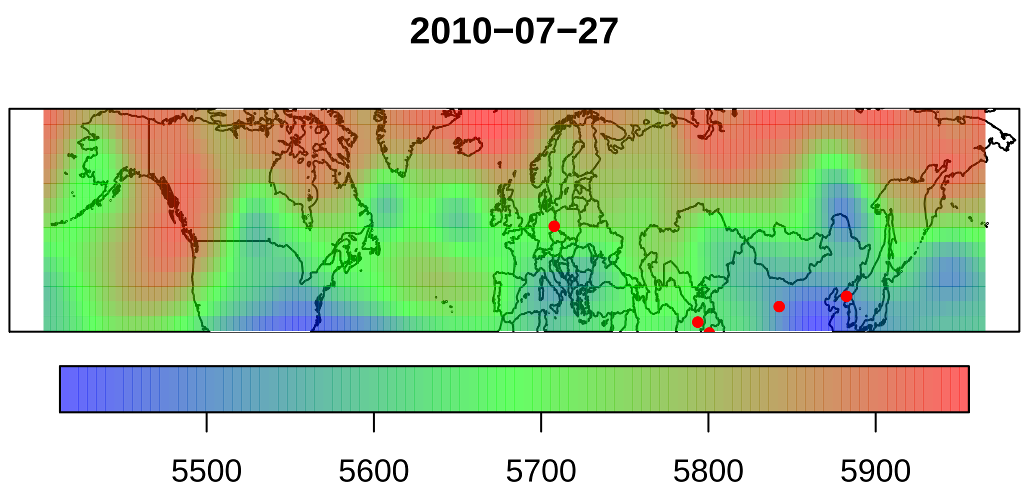
We can see that floods often happened at coastlands in India, and at east area of India, floods frequently happened as well.

Pressure Distribution of Days With More than 4 Floods

We selected several days with the most occurrences of floods and ploted the distribution of the pressure of given area.

```
## [1] "2010-06-22" "2010-07-27"
```

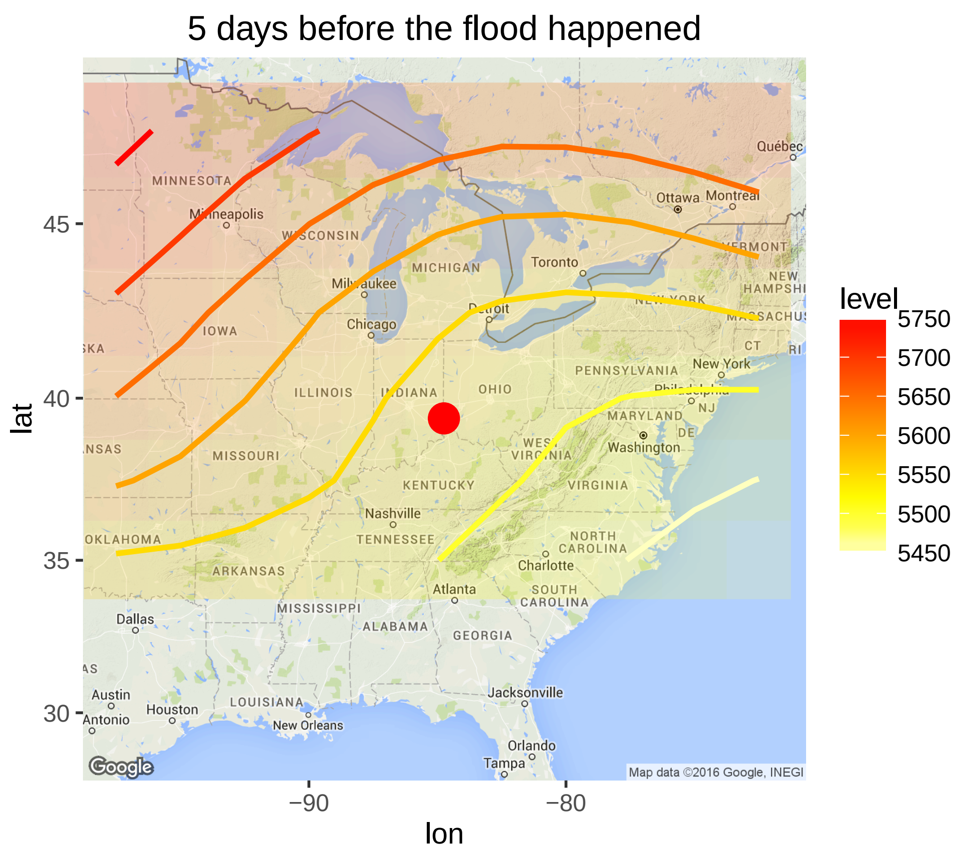




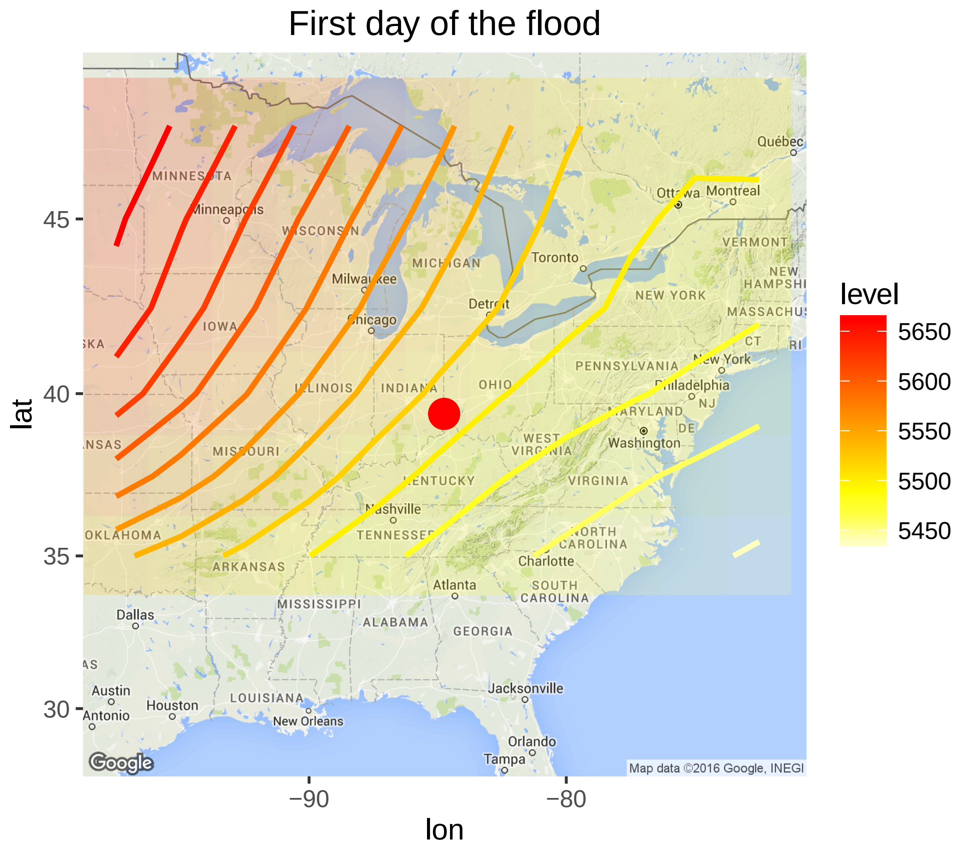
According to the plots, we can see that many floods occurred in the areas with lower pressure, detailed analysis will be illustrated below.

Pressure Distribution of Several Floods

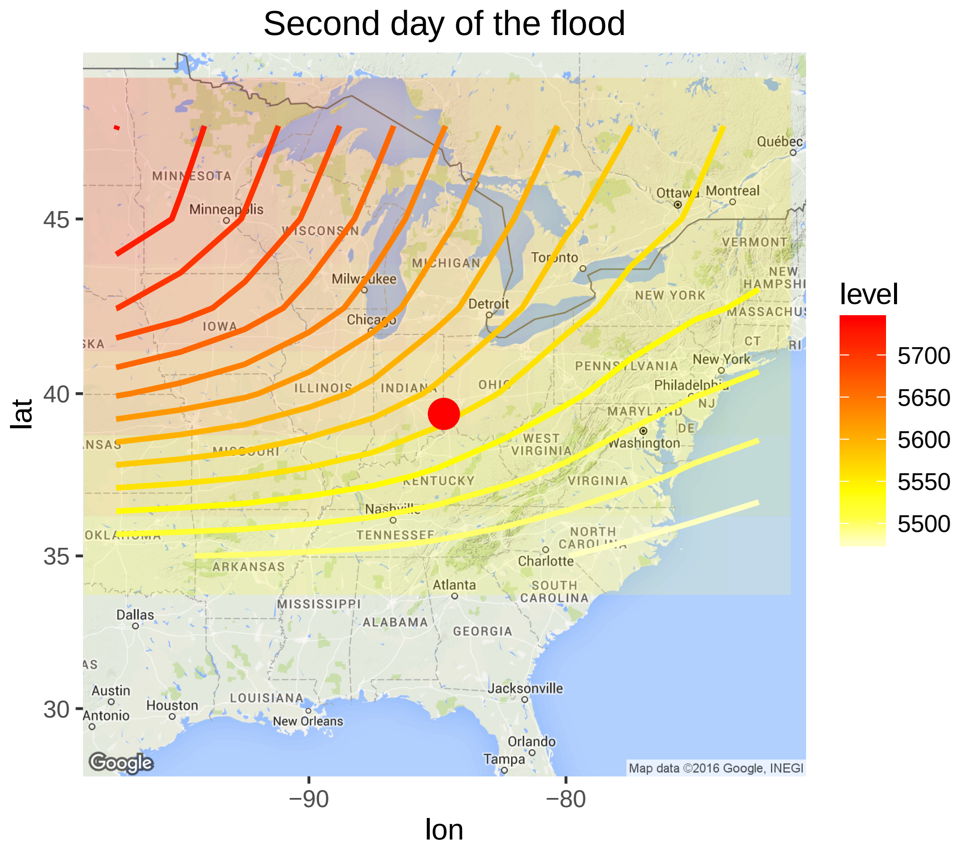
Firstly, we will focus on changes of contours during the flood that happened in the area of Southern Michigan, central Indiana, and western Ohiothe in the US from Jun 27, 2015 to Jun 29, 2015.



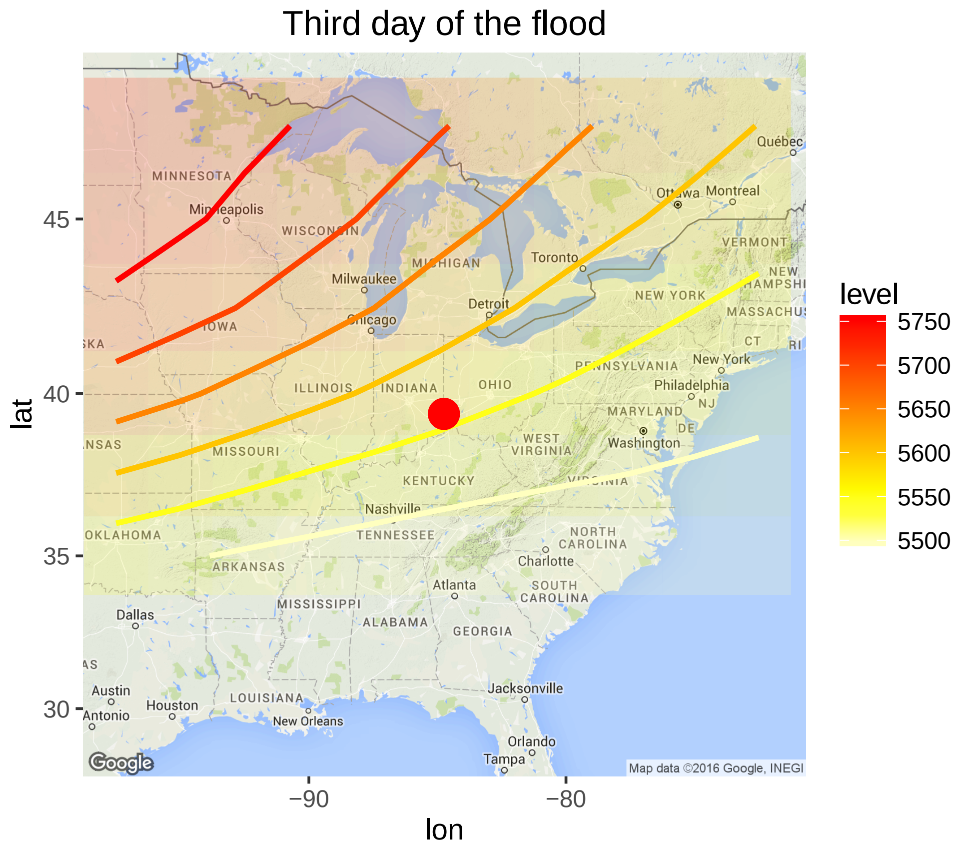
This is a contour information of pressures at Jun 22, 2015. We also draw where flood happened by using read dot. At “level” bar on the right of the map, values of contour are written. For example, the area that has deep red has high pressure. We can see that pressures between each area is wide.



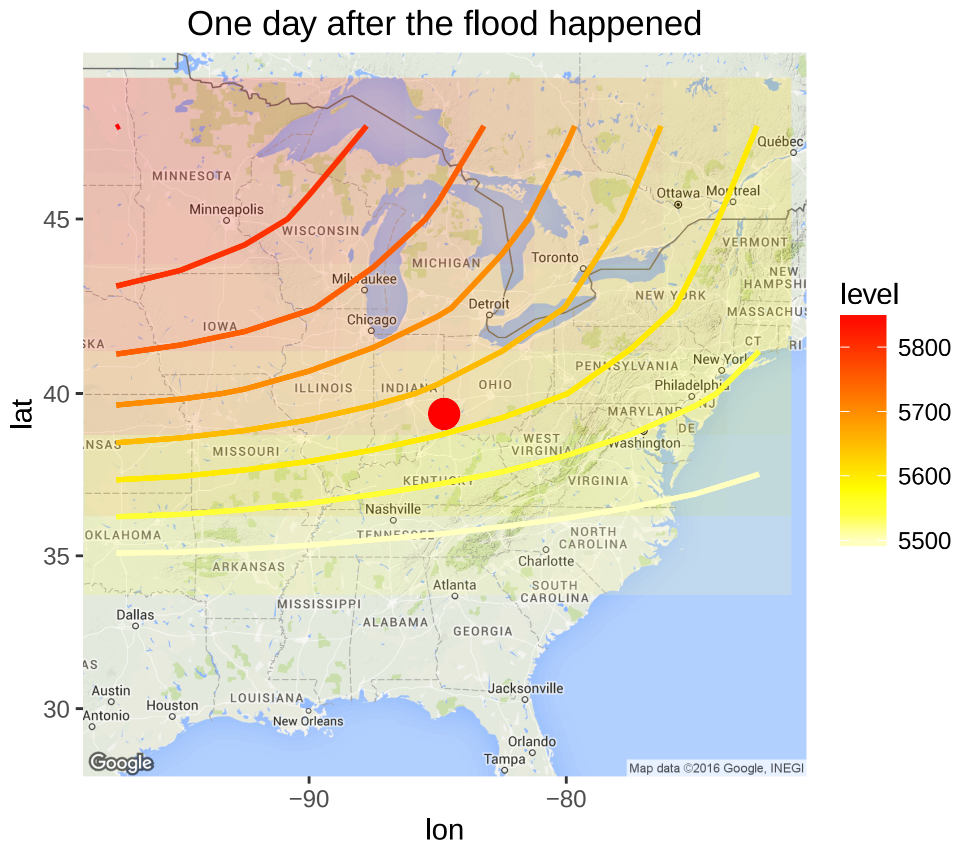
This is a contour information of pressures at Jun 27, 2015. As we can see, pressures between each area is narrow, and there are high range of pressures in this area. Also, at the flood point, they had a value of the pressure that was around 5500.



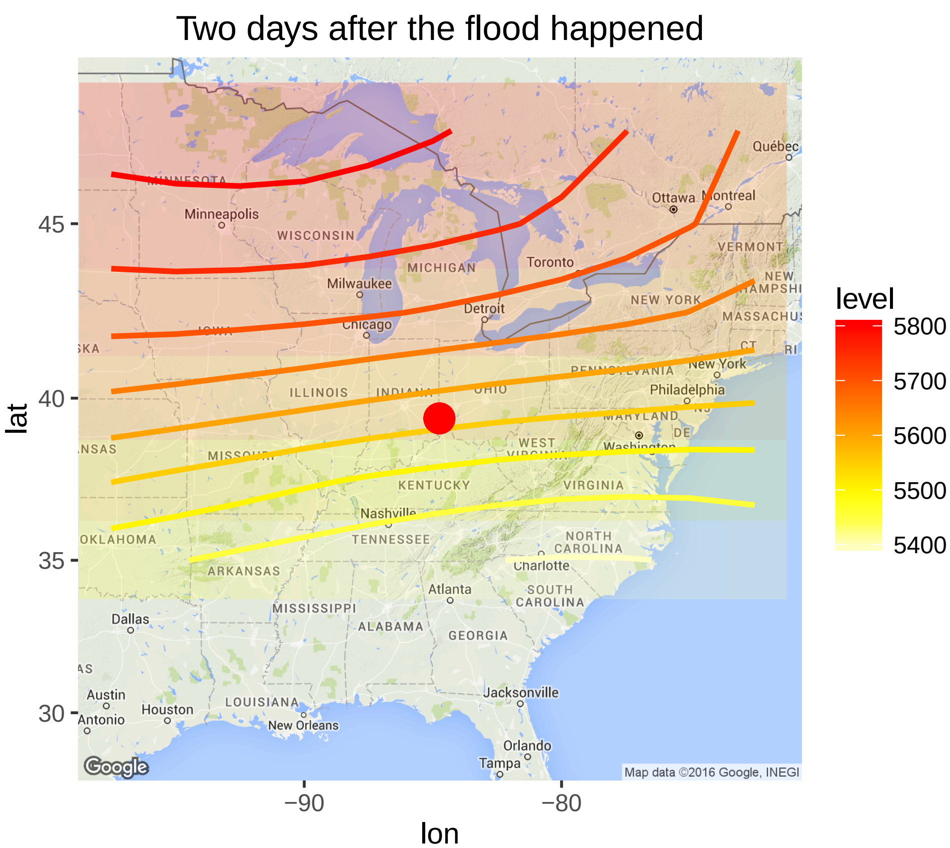
This is a contour information of pressures at Jun 28, 2015. As we can see, pressures between each area is narrow as well. At the flood point, they had a value of the pressure that was around 5500.



This is a contour information of pressures at Jun 29, 2015. Pressures between each area becomes wider. At the flood point, they had a value of the pressure that was around 5550.



This is a contour information of pressures at Jun 30, 2015. It seems that they had higher pressure value (around 5600) compared with data while flood was happenin.



This is a contour information of pressures at July 1, 2015. As same with the previous map,they had higher pressure value (around 5600) compared with data while flood was happenin.

PCA of Pressure Data

```
## dimensions:
##         T = 24873 ;
##         X = 144 ;
##         P = 1 ;
##         Y = 15 ;
## variables:
##         float T(T) ;
##                 T:standard_name = "time" ;
##                 T:pointwidth = 1 ;
##                 T:long_name = "Time" ;
##                 T:expires = 1454938800 ;
##                 T:calendar = "standard" ;
##                 T:gridtype = 0 ;
##                 T:units = "days since 1948-01-01 12:00:00" ;
##         float X(X) ;
##                 X:standard_name = "longitude" ;
##                 X:pointwidth = 2.5 ;
##                 X:long_name = "Longitude" ;
##                 X:gridtype = 1 ;
##                 X:units = "degree_east" ;
```

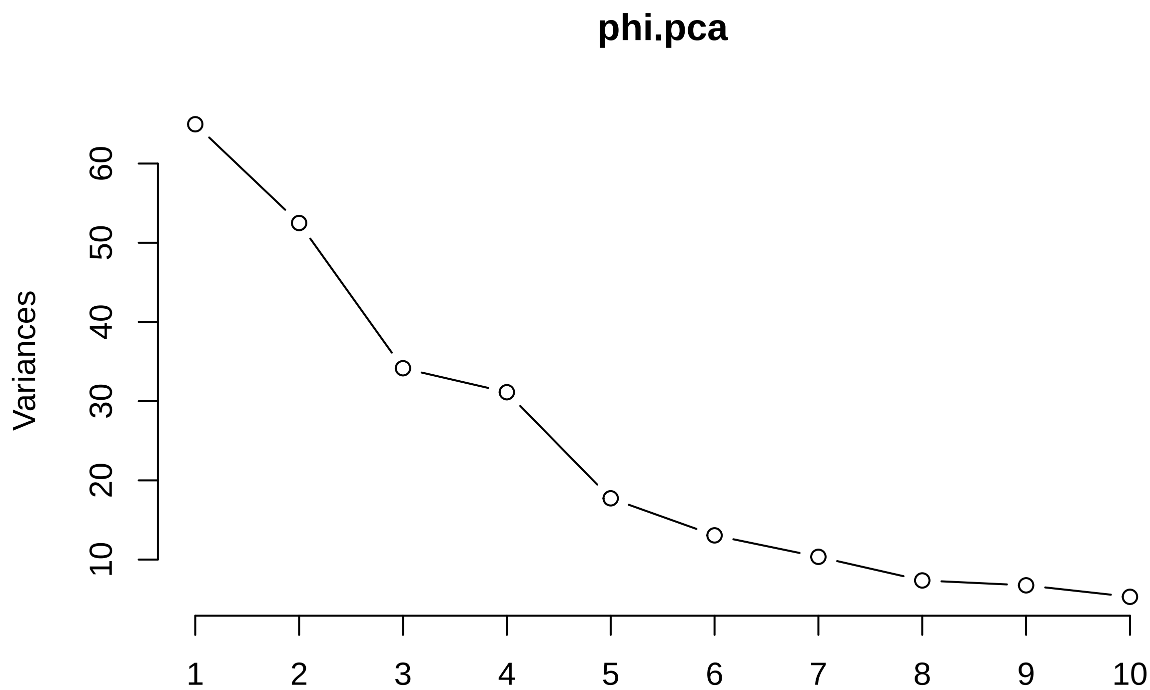
```
##         int P(P) ;
##                 P:long_name = "Pressure" ;
##                 P:gridtype = 0 ;
##                 P:units = "mb" ;
##         float Y(Y) ;
##                 Y:standard_name = "latitude" ;
##                 Y:pointwidth = 2.5 ;
##                 Y:long_name = "Latitude" ;
##                 Y:gridtype = 0 ;
##                 Y:units = "degree_north" ;
##         float phi(X, Y, P, T) ;
##                 phi:pointwidth = 0 ;
##                 phi:history = "T:  0000 1 Apr 2002 to 0000 5 Feb 2016 appended from datestring" ;
##                 phi:calendar = "standard" ;
##                 phi:center = "US Weather Service - National Met. Center" ;
##                 phi:gribparam = 7 ;
##                 phi:gribleveltype = 100 ;
##                 phi:gribvariable = 7 ;
##                 phi:PDS_TimeRange = 113 ;
##                 phi:process = "(180) 62 wave triangular, 28 layer Spectral model from "Medium Range 
##                 phi:GRIBgridcode = 2 ;
##                 phi:gribNumBits = 9 ;
##                 phi:gribfield = 1 ;
##                 phi:subcenter = "NCEP Ensemble Products" ;
##                 phi:scale_min = -605 ;
##                 phi:grib_name = "HGT" ;
##                 phi:missing_value = 9.999e+20 ;
##                 phi:PTVersion = 2 ;
##                 phi:scale_max = 32480 ;
##                 phi:expires = 1454938800 ;
##                 phi:units = "gpm" ;
##                 phi:long_name = "Geopotential height" ;
##                 phi:standard_name = "geopotential_height" ;
```

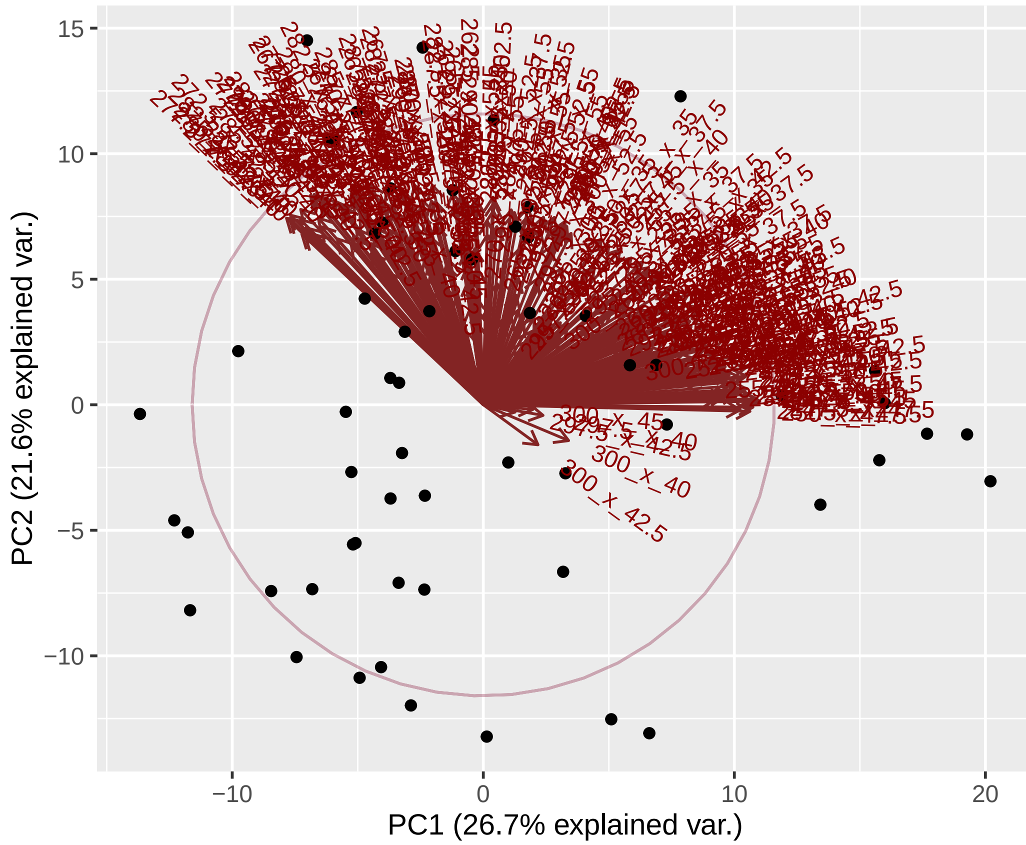
```
## [1] 5771
```

```
## [1] 24873  2160
```

```
## [1]  60 261
```

```
## Importance of components:
##                          PC1    PC2    PC3    PC4    PC5     PC6     PC7
## Standard deviation     8.060 7.2453 5.8443 5.5795 4.2113 3.61319 3.21658
## Proportion of Variance 0.267 0.2158 0.1404 0.1280 0.0729 0.05366 0.04253
## Cumulative Proportion  0.267 0.4828 0.6232 0.7511 0.8240 0.87769 0.92022
##                            PC8     PC9    PC10
## Standard deviation     2.71364 2.59776 2.30177
## Proportion of Variance 0.03027 0.02774 0.02178
## Cumulative Proportion  0.95048 0.97822 1.00000
```


phi.pca
Variances
10
20
30
40
50
60
1
2
3
4
5
6
7
8
9
10


PC1 (26.7% explained var.)
PC2 (21.6% explained var.)
300_x_45
300_x_40
300_x_42.5